MINING AND PETROLEUM STANDARD

AND

AMERICAN GAS-LIGHT JOURNAL.

Devoted to Mining, Petroleum, Gas, Water Supply, and Scientific Subjects Generally.

PUBLISHING OFFICE NO. 22 PINE STREET.

VOLUME IX—No. 13. WHOLE No. 193 | NEW YORK, THURSDAY, JANUARY 2, 1868. | $3 PER ANNUM IN ADVANCE.

Root's Patent Trunk Engine.

The name "trunk" engine is applied to that class of reciprocating engines in which the connecting-rod passes partly or entirely through the cylinder, and is inclosed in a tube or "trunk" which also passes partly or entirely through the cylinder, the piston-rod being dispensed with, and the engine being made much shorter than the ordinary reciprocating engine. Owing to its great compactness, simplicity, fewness of parts, and lightness, it has always held a high position in the esteem of many of the most eminent engineers in America and Europe, and this notwithstanding its defects as formerly constructed.

The objections to trunk engines as formerly built have been, side strain and wear upon the cylinders, piston, and stuffing-boxes, resulting from the short connecting-rod, which was attached to the trunk in its center and opposite to the piston-head, thus throwing upon these parts at a severe angle the wear and pressure that is borne in the ordinary engine by the cross-head and guides. This side strain and wear caused leakage at the stuffing-boxes, as on account of their large size, it was difficult to keep them steam-tight without excessive friction. The inaccessibility of one end of the connecting rod, owing to its being attached in the center of the trunk, has rendered it difficult to keep the boxes properly adjusted. In the engine illustrated in this article it is claimed that the defects above mentioned have been entirely obviated.

In fig. 1 is seen a perspective view of the engine, and in fig. 2 is shown a vertical section of the same. The same letters refer to the same parts in each. The cylinder, A, is cast with an exhaust-chamber, P, running entirely around it, thus jacketing the cylinder with exhaust steam and preventing condensation. The steam-chest, J, and the lower cylinder-head are also cast on the cylinder. The trunk, D, passes entirely through the cylinder and cylinder-heads, and has a reciprocating motion given to it by the pressure of the steam alternately upon the upper and under sides of the piston, C, which is cast on the trunk. Within this trunk, the connecting-rod, E, swings and is connected with it by the cross pin, W. The connecting-rod imparts motion to the shaft, F, by being connected with it by the crank, G, and the crank-pin, H. The trunk is kept in line while reciprocating by the upper guide, B, cast on the upper cylinder head and the lower guide, B′, bolted on the lower cylinder-head, thus relieving the cylinder and piston from side wear. As the insides and ends of the cylinder and guides, faces of cylinder-heads, and the outside of the trunk and piston are all turned and fitted up in a lathe, the piston must necessarily run true with the inside of the cylinder, or in other words, the centers of the cylinder, both guides, trunk, and piston, must always be in one line.

The stem is worked in the usual manner by the eccentric, N, fig 1, and valve-rod, M. The course of the steam through the valves, steam-ports, O, cylinder and exhanst-port, P, will be readily understood.

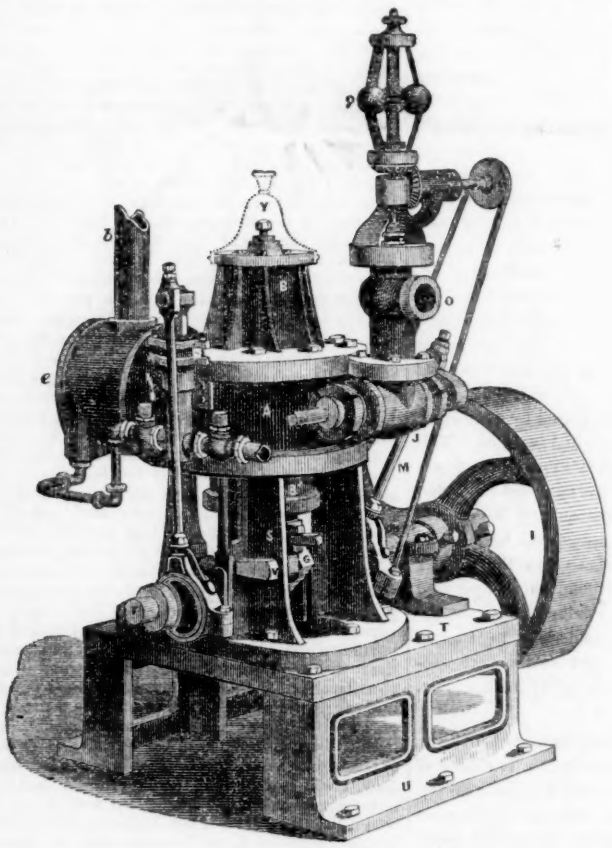
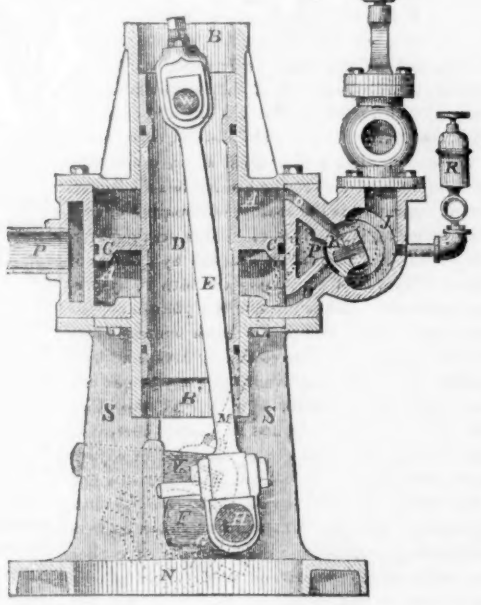


Fig. 2.



ROOT'S PATENT TRUNK ENGINE.

The frame, S, is bolted to the lower cylinder-head; T is the bed-plate, and U the pedestals; V is a key to tighten up the journals; B′ outside bearing; I flywheel; Y the cap or cover over the trunk; Q the governor, and R the oiler. In fig. 2 is shown the heater, *e*, and it also shows the way in which it is attached, although the form or location may be varied as desired; the exhaust pipe is shown at *b*.

As this is a quick-running engine, making a higher number of revolutions than the common engine, the points in each revolution at which the steam is exerting its minimum and maximum force, or in other words,

the position of "on center" and "half-stroke," when the power is greatest, occur with so much greater frequency than in the common long-stroke engine, a sufficient momentum and regulating power is obtained from a fly-wheel of far less weight than is required in the ordinary engine, where these points occur at so much longer intervals and where a far greater amount of momentum and weight is required to carry the engine and machinery from one dead point to another.

A ligatness of working parts is also carried out in all parts of the engine; but owing to the strain being direct through the center, and their great compactness, it does not detract from the necessary strength. A 20 horse-power engine occupies a floor space of 36 by 52 inches, and is 61 inches high. A 40 horse-power 60 by 72 inches floor space and 7 feet high, including fly-wheels.

This engine took a prize medal at the Paris Exposition over other American and foreign manufactured engines, and also a premium at the late Fair of the American Institute.

Its compactness, simplicity and durability as now constructed, seems to make it eminently calculated to meet the requirements of gas works, as well as for general purposes.

These engines are manufactured by the "Root Steam Engine Company," No. 500 to 508 Second avenue, corner of Twenty-eighth street, and No. 303 East Twenty-eighth street, New York City, under patents of John B. Root, dated respectively August 7, 1866, August 14, 1866, and on May 21, 1867.

Coating Iron or Steel with Copper.

Letters patent have been taken out in England for "a new or improved process or method of coating or covering iron and steel with copper or copper alloys," by Maynel Bernabe, of Paris.

This process or method, says the patentee, is based upon the employment of electro-metallurgy applied to cover iron or steel with a coating or covering of copper or copper alloys, such as brass or bronze. The invention is applicable to the coating or covering of armor plates, rollers for cotton and other printing, boiler tubes and plates, engine fittings, gates, church fittings, lamp posts, and all iron work in general, and by it I am enabled to employ iron coated with copper for many purposes for which solid copper has hitherto been employed. The first operation is the cleaning or scouring when necessary. The iron or steel articles are then immersed in a vessel containing a suitable acid liquid. The second operation is the coating with copper or copper alloy by galvanism. The cleaned or scoured articles are placed in a bath made alkaline by cyanide of potassium. The vessel containing the bath is, by preference, stoneware. In the interior is a plate of copper or copper alloy facing, and of the same dimension as the iron or steel article to be coated or covered. The two conducting wires of a galvanic pile are placed one in connection with the copper or alloy, and the other with the iron or steel article, and an electric current is thereby established, which causes a deposit of copper or copper alloy upon the iron or steel article: in a few hours the layer deposited is sufficiently thick to insulate or separate the iron. The third operation consists in strengthening or increasing the first layer of copper or alloy which covers the iron or steel article by submitting the article to a second galvanic coppering. For this purpose the article already coated with copper or copper alloy is immersed in an acid bath of sulphate of copper, a plate of copper or copper alloy of the same dimensions being placed opposite the iron or steel article. The bath is contained in a wooden vessel, and is also traversed by an electric current from a pile. The iron or steel articles should be left in this bath for from one to two days or more, according to the thickness of coating or covering required.

No Practice There.—An old lady announced in a Court at Atlanta that she "had no counsel—that God was her lawyer." "My dear madam," replied the Judge, "he does not practice in this Court."

Purification of Gas.

[From "Clegg on the Manufacture of Coal Gas."]

(Continued from page 178.)

Having thus given a brief sketch of the history of the process of purification by the oxide of iron, we shall now explain the chemical phenomena connected with the action and reaction of that agent on impure coal-gas.

The impurity removed from the gas by oxide of iron is sulphuretted hydrogen and cyanogen, which form only two sevenths, at the most, of the impurities contained in foul coal-gas. To remove the carbonic acid, which constitutes the principal remaining portion, lime is required, and in almost as large a quantity as if no oxide of iron had been employed. On sulphuretted hydrogen the hydrated and anhydrous forms of the sesquioxide of iron act precisely in the same manner, except that the anhydrous oxide is more active, and evolves more sensible heat than the hydrated. In both cases water is formed, sulphur is deposited, and protosulphuret of iron is produced; and in both cases the water which is formed remains uncombined with the metallic sulphuret, and may be driven off by the continued action of a current of hydrogen gas heated to 212° Fahr. Whichever form of peroxide of iron is used, the resulting product is the same, and consists of free sulphur and anhydrous protosulphuret of iron mixed or unmixed with water, according to fortuitous circumstances. When, however, a mixture of this kind is exposed to the air the iron absorbs oxygen and parts with its sulphur, a small portion of which also absorbs oxygen and produces sulphuric acid, more especially if any ammonia or other alkaline matter be present in the material; and as no water is combined with the sulphuret prior to this oxidizing process, the resulting oxide of iron must be anhydrous, whatever form of the oxide may have been originally employed. This accounts for an otherwise inexplicable fact, that when the hydrated sesquioxide is used the first time, it purifies only about half as much gas as on the second and third times of being used, when it has become in a great measure anhydrous. It has been found, indeed, by experiment, that in the first trial of a given quantity of hydrated oxide of iron placed in a dry-lime purifier, it purified only 1500 cubic feet of gas; on its second trial, after exposure to the air, it purified 2400 feet: that after a second exposure to the air it purified 3050 feet; and after another exposure, the gas purified by the same quantity of oxide of iron amounted to 4200 cubic feet, or nearly three times the original volume. This agrees with the result of the daily experience of gas engineers. It may therefore be assumed not only that the hydrated oxide becomes anhydrous by the process of revivification, but that the anhydrous form is the more active condition of the two, though the greater activity of the latter does not depend on its hydrated or anhydrated condition, but is attributable to the peculiar molecular arrangement, analogous to that of spongy platinum, cobalt, nickel, and some other substances, in which state a larger extent of surface is exposed to act upon the gas.

One of the greatest disadvantages connected with the oxide of iron process of purification is the tendency of the sulphuret of iron to ignite and become red-hot. When this happens, and is not checked at the commencement, the fire spreads through the entire mass, volumes of sulphurous acid are given off, the air becomes unfit for respiration to a considerable distance, and the oxide of iron is in a great measure spoilt. Nothing but great care can prevent the occurrence of such an accident, for it arises apparently from the same cause which leads to the ignition of metallic iron when in a state of minute division, such as results from the reduction of oxide of iron at a low red-heat by hydrogen gas.

The chemical and molecular actions that take place when sesquioxide of iron is exposed to impure coal-gas, and afterwards to the action of atmospheric air, are not yet thoroughly understood. According to theory, not more than 16 lbs. of oxide of iron should be required to remove the whole of the sulphuretted hydrogen produced from a ton of coal, but it usually takes about four times that quantity to produce the desired effect. The oxide may be used over and over again, until the quantity of sulphur in it becomes so great that by fusing during the revivification it seals up the particles of metallic oxide so as to prevent their further action on the foul gas, when of course a fresh supply is required.

The use of lime subsequently to that of the oxide of iron for the purpose of removing the carbonic acid ought never to be omitted.

The evidence of the numerous scientific witnesses examined at the trial respecting the validity of Mr. Hills's patent confirmed in all essential points the foregoing account, condensed for the most part from the 'Journal of Gas Lighting,' of the process of purification by the oxides of iron. The principal point on which Mr. Hills rested his claims was, that previous to the date of his patent no one had knowingly used the *hydrated* oxide of iron for the purification of gas; and he endeavored to show that the oxides of iron previously used have no effect in purifying gas. It was stated, however, that there are several forms of hydrated as well as of anhydrous oxides of iron which will not combine with sulphuretted hydrogen, and that the condition of the metallic salt which renders it suitable or otherwise for the purification of gas depends more on the mechanical arrangement of the molecules than on its chemical constitution.

Messrs. Lowe and Evans obtained a patent in February, 1852, for imparting this peculiar condition to anhydrous oxide of iron. The form of peroxide of iron claimed by them is an allotropic state of the anhydrous peroxide, induced by the action of alkalies and alkaline salts on the oxide of iron at a red-heat. The specification of this patent mentions various modes of preparing the material by means of caustic potash or soda mixed with the oxide and subjected to a dull red-heat; and even heat alone, provided it does not reach a bright red, is stated as one of the means of imparting this peculiar absorbing property to the common hydrated peroxide of iron.

In Mr. Evans's report to the directors of the Chartered Gas Company, dated January 26th, 1850, on the result of Mr. Laming's mode of purifying coal-gas, he thus described the process as put into operation experimentally at the Westminster gas works: "The material used consists of muriate of iron decomposed by lime, which forms muriate of lime and oxide of iron. This is mixed with water and absorbed into sawdust and put into the ordinary dry-lime purifier. The sulphur in the gas immediately combines with the oxide of iron, forming sulphuret of iron; the ammonia is at the same time taken out by means of the muriate of lime; the carbonate of ammonia in the gas effecting a double decomposition, part of the carbonic acid combining with the lime and the muriatic acid with the ammonia. The experiment was tried on a small scale with the experimental purifiers, and was commenced on the 8th of August, 1849. It was found to remove the sulphur and ammonia most completely from the gas, but when the material was saturated, which it soon was, it was taken out and fresh put in. If this had continued to be the way of proceeding it would have been quite a failure, on account of the expense; but it was observed accidentally that the material had the property of recovering its former purifying power by exposure to the atmosphere, and on putting it into the purifier a second time it purified the gas as well as the first time, and on taking it out a second time it was equally effective again." Mr. Evans then proceeded to observe, in reference to the cost of the process as compared with lime: "In order to give the Court same data to form an opinion of the advantages or otherwise of this process over ous mode of purifying by means of lime, I will assume that the experiment had been perfectly successful, and compare the cost of the two, by which it will be seen, if Mr. Laming's plan was adopted, it would occasion an additional outlay of £489 10s. or 294d. per 1,000,000 feet over our present system, which is simple, cheap and effective."

(To be continued.)

Pleasures of Reading.—Of all amusements that can possibly be imagined for a working man, after a day's toil, in the intervals, there is nothing like reading a newspaper or book. It calls for no bodily exertion, of which the man has had enough—perhaps too much. It relieves his home of dullness and sameness. Nay, it accompanies him to his next days work, and gives him something to think of besides the mere mechanical drudgery of his every day occupation—something he can enjoy while absent, and look forward to with pleasure.

More Water for San Francisco.

THE SAN FRANCISCO WATER COMPANY—A GIGANTIC PROJECT—A PROSPECT OF PLENTY OF WATER AT LAST—PESCADERO CREEK TO BE PUT ON TAP—THIRTY MILLION GALLONS OF WATER A DAY.

[From the San Francisco Times]

From a very remote period in history, the question of supplying a sufficiency of water for the consumption of the population of great cities, has been deemed worthy of the first consideration, and the utmost engineering skill attainable has been brought to bear upon it, by the most powerful and civilized nations. The vital importance of an ample supply of this necessary element has been everywhere recognized, and no pains or expense have been considered too great in securing it. A deficiency of water in a large city is one of the greatest calamities that can occur. It involves terrible danger from disease, from fire, from filth, from drought, and the larger the population, the more extensive must be the peril. At the present time San Francisco is supplied with water by a single company, whose reservoirs, until recently, were perhaps sufficient for ordinary purposes. But with the rapid extension of the city has come the discovery that this supply cannot much longer be depended upon as an entirely ample one, and even now the want of power occasioned by the levels at which it is run, exposes the higher portions of the town to great risk, in the event of an extensive conflagration, while it is difficult, perhaps we should say impossible, to obtain a sufficiency of water for keeping the streets in order during the dry season. In view of these facts a company has been organized for the purpose of bringing an ample supply of water into San Francisco from a considerable distance, and the works proposed will be upon a scale of great magnitude. Before proceeding to describe them in detail, however, we propose to give some account of the great water works of ancient and modern times, in order that our readers may be enabled to estimate fully the magnitude of the work about to be undertaken by the San Francisco Water Company.

ANCIENT AQUEDUCTS.

The use of aqueducts to supply cities, may be traced back to a very remote period in Persia and Judea. The pools of Solomon, near Bethlehem, described by Stephens in his *Incidents of Travel*, were three large reservoirs connected with each other, from which water was conveyed to Jerusalem, six miles distant. One of these pools was 660 feet in length and 280 in breadth. Jerusalem is still supplied by them, through a ten-inch pipe. The ancient City of Mexico, on this continent, was supplied with water by the aqueduct of Chapultepec, built by Montezuma, and carried across the lake upon a causeway. But no aqueducts, ancient or modern, equal in length or in expense those constructed by the Incas of Peru. These passed along the precipitous sides of the Andes, winding around the bases of the mountains, penetrating some by tunnels worked through the solid rock without iron tools, and crossing the frightful *quedebras* or chasms, upon solid masonry. The conduit was constructed of large slabs of freestone, fitted together closely without cement. The aqueduct which crossed the valley of Condesugu was between 400 and 500 miles in length. In Egypt similar works were constructed under Sesostris, and in Babylonia under Semiramis. The Romans, however, excelled all other nations in the skill displayed by them in the construction of those works. Their aqueducts were built on a grade of regular descent, winding round the hills, or penetrating them by tunnels, and in the low levels supported on arches, which sometimes, as in the New Anio, extended for over six miles in one continued series, many of the arches being more than 100 feet in height. The whole length of this aqueduct was 63 miles 700 paces. The Aqua Martia also, which extended 38 miles, contained 7,000 arches. The capacity of these works was wonderful in proportion to the population. It is estimated that 50,000,000 cubic feet of water must have been supplied daily to a population of 1,000,000, or about 312 Imperial gallons to each individual. There was certainly no excuse for squalor or dirt within the seven hilled city in those days. The Romans built many other great aqueducts, of which the one at Metz, in Belgic-Gaul, is the most remarkable. In France, in the reign of Louis XIV., an aqueduct of vast expense was constructed to supply Versailles with water. The bridge of Maintenon, built to support this aqueduct, is said to be the most magnificent structure of the kind in the world. It is about 4,400 feet or seven-eighths of a mile in length, upward of 200 feet in height, and is constructed of three tiers of arches one upon another, 242 arches on each tier, and having a span of 50 feet. There are several other noble aqueducts recorded in history; but our space renders it impossible even to mention them. We will now come down to modern times, and slightly review the great water works at present in active operation.

MODERN AQUEDUCTS—THE MARSEILLES WATER WORKS.

The great water works for supplying Marseilles have been over twenty years in course of construction. The aqueduct is a canal of 60 miles long. It passes through several chains of limestone mountains by no less than forty-three tunnels, the length of which is eight and a half miles, and is carried across a ravine, five miles from Aix, by a structure of masonry 262 feet high, and 1,287 feet long. The quantity of water that flows through it is 198,000 gallons per minute. The cost in 1852, some time previous to its completion, had been over $10,000,000.

THE CROTON AQUEDUCT.

Of all modern works of this kind, the Croton Aqueduct of New York is undoubtedly the most magnificent and extensive. It was commenced in 1837, and completed in 1842, at a total cost, including commissions and interest, of $12,500,000, of which $1,800,000 was paid for distributing pipes, right of way, and other incidental charges. The whole length, from its source at Croton river to the distributing reservoir on Fifth avenue and Fortieth street, is 40½ miles. A dam constructed across the river raised the water 40 feet, and formed the Croton lake, which covers about 400 acres. This is the collecting reservoir, and contains 500,000,000 gallons, with a depth of six feet. The flow of the Croton is about 27,000,000 gallons daily, at its lowest stages. In a period of drought, the reservoir can furnish 8,000,000 gallons extra daily, for a period of sixty-two days, thus raising the supply to 35,000,000 gallons, and facilities exist for obtaining a still further supply, by constructing other reservoirs higher up the stream. From the dam to the Harlem river, nearly 33 miles, the aqueduct is built of stone, brick and cement, arched over and under, 6 feet 9 inches wide at the bottom, 7 feet 9 inches at springing line of the arch, and 8 feet 5½ inches high; area of cross section 53½ square feet. Its capacity is equal to 60,000,000 gallons daily. The inclination is 1.1088 feet per mile, 33.92 feet in the 33 miles, and the velocity of the water 1½ miles an hour. Across Harlem river the aqueduct is carried upon the High Bridge, in two iron pipes of 3 feet in diameter, which are laid 12 feet lower than the bottom of the conduit, on the north side of the river, and 10 feet below the aqueduct on the south side. The whole hight of the bridge, above high water mark, is 114 feet. The receiving reservoir covers an area of over 35 acres, and is capable of containing 150,000,000 gallons. From this to the distributing reservoir, a distance of 2½ miles the water is conveyed in three lines of iron pipes of 3 feet diameter. The capacity of this reservoir is about 20,000,000 gallons. It is a stone structure 45 feet high above the streets, covering a little more than 4 acres. The water for supplying the city is taken from this reservoir and conveyed through more than 134 miles of pipe, the mains being 3 feet in diameter, and the smallest 4 inches. The annual interest on the cost of this gigantic work is $665,000, and this sum is raised by a water tax, while the capital is gradually redeemed by means of a sinking fund. An addition is now being made to the Croton Aqueduct, in the shape of high service works On the cliff immediately south of the High Bridge over Harlem river, a reservoir will be built, covering about seven acres of land. The depth of water in the reservoir will be 16 feet, and its capacity 10,794,000 gallons. It is intended to supply, during times of repairs or accidents, that portion of the northern district of the city which lies above the level of the present aqueduct and its reservoir. Near to this structure will be a tower of masonry, 170 feet high, containing a stand-pipe and an iron tank with a capacity of 47,000 U. S. gallons. The Croton Aquednct is a distinct department in the municipal government, organized under a law of the Legislature in 1849. It is managed by a board of three commissioners, and under their supervision were placed also the sewerage and the paving. The work of repaving and repairing the streets, however, was transferred to the Street Department, for the current year, under an Act of the Legislature.

(To be continued.)

People's Gas-Light Company.

[From the Cleveland (Ohio) Herald.]

The second company in the city of Cleveland, incorporated to carry on the manufacture of gas for general consumption, went into operation on Monday, Dec. 2d. It will be known as the "Peoples Gas-Light Company." The works are located on the north end of Pearl street, West Side, which portion of the city they are intended to supply. The office is at No. 197½ Franklin street. Capital stock, $150,000.

The motive which induced the people of the West Side to enter into competition with the old gas company was, they allege, a matter of convenience. Frequent breaks of the pipe in the river led to provoking delays in the reception of gas from the East Side, and in this respect the West Side people claim the new works will be a matter of convenience.

The first shovel full of earth was removed from the foundation of the new works on the 15th of May, 1867, under the superintendence of Mr. R. Cartwright, who is the constructing engineer of the concern. The whole would have been completed and set in operrtion Oct. 1st, had it not been for the delay in the erection of the gasometer, which was manufactured in Philadelphia by G. W. Kraft, a veteran gasometer builder.

Since the 7th of August over six miles of main pipe have been laid in the most substantial manner through such leading streets as Pearl, Detroit, Lorain, Franklin, Clinton, Church, Kentucky, etc. Every foot of pipe has been tested to an amount of pressure thirty times greater than that actually carried.

The pipes have been laid on both sides of Detroit street to prevent any damage being done to the Nicolson pavement, where it will be necessary to make house connections in the future. The people on all of those streets have manifested an interest in the prosperity of the new company akin to that which is felt by all who desire to regulate their own domestic affairs. Its stockholders and officers are men of marked business qualifications, living on that side of the river. Their energy in the prosecution of this enterprise has stamped the word "success" on its future operations. The names of the officers and directors are:

President—E. M. Peck.
Treasurer—J. Bousfield.
Secretary—S. J. Lewis.
Directors—Elias Sims, Nelson Purdy, R. B. Dennis, E. M. Peck, and J. Bousfield.

The engineer, Mr. R. Cartwright, having had many years' experience in the erection and superintendence of such works, has satisfied the Directors and all who have studied the general principles connected with the manufacture of gas, that his work will be of the utmost importance in turning out a first rate article of gas. He came highly recommended, from Meadville. The gas works of that place were built under his supervision. He also bore testimonials from the cities of Fredericksburg, Va., Ithaca and Geneva, N. Y., and from the Northern Liberties Gas Works, of Philadelphia, having superintended the erection of the gas works in each of those places. He claims to have placed all the modern improvements for securing the best quality of gas in the West Side Works. All gas men, ladies and the public generally, are invited to visit and inspect neat apartments, where they would naturally expect to find smoky, dusty, dingy walls and halls, so common about works where coal gas is made.

The retort house contains seven benches, of five clay retorts each, all fitted up with Stanley's Patent Hydraulic Main. The total capacity of this house is 175,000 cubic feet in 24 hours.

The purifying house contains room for four purifying boxes, with a capacity of 400,000 cubic feet in 24 hours. In the matter of purifying, the boxes gave ample evidence of having been properly arranged when the writer visited the works. There were no signs of impurity, such as sulphur, ammonia and carbonic acid.

The gasometer, 80x20 feet, with a capacity of 100,000 feet, has been mentioned. In addition to their present admirable facilities for manufacturing gas, the Company have room to extend their buildings to a manufacturing capacity of 500,000 cubic feet per day, without purchasing a foot of land. They, of course, like all other gas works, run day and night. A squad of workmen are busily engaged in putting up meters, and in making all other arrangements for a constant and uniform supply of illuminating gas to the patrons of the "People's Gas-Light Company."

Practical Management of Gas Works

[Written Exlressly for this Journal.]

In the series of articles of which the present is to serve as the salutatory, their author is well aware that the task which he is assuming is a very delicate one.

The opinions of engineers are various upon certain episodes in every-day practice, and, while to harmonize these diversities is hardly the province of the essayist he may, without any suspicion of assumption, so present them as to furnish food for the thinking mind.

And whether or not this record of hard solid facts of practical means to practical ends, be met with favor by its readers, it cannot but be conceded to be a properly directed attempt to strip the art of gas-making of the tinsel and mysticism of sublimed science—to give the engineer matter for habitual reference, and to afford a standard by which he may judge of his own results. Clegg, Peckston and Hughes, are volumes necessary to a gas-engineer's library, and highly useful in elucidating the more abstruse principles of matured excellence in his profession; but they take too much as granted, and ignore the *substructure* of facts and results which the gas maker must build up for himself, as best he may, by a hard and sometimes a sad experience. What does the manager of a small gas-works care whether coal-gas contains "chlorodibromanaline" or not, so long as he gets 10,000 feet from the ton of coal, and 5,000 feet per diem per retort? What does it interest him to study the absorptio-metric miracles of the chemist, if the same time spent in his retort-house or in the streets, will improve his heats or diminish his leakage? This vacuum in gas literature has been long acknowledged, and if the present articles do not perfectly fill it, they will at least serve as a nucleus around which the suggestions and comments of American gas-makers may cluster themselves into a shapely and valuable mass. It cannot be supposed that the opinions to be advanced and the practical *minutiæ* to be detailed will chime entirely with the experience of my brother engineers; but a confident appeal is made to their courtesy and forbearance to accept the spirit of diffidence in which I write, as some palliative of possible errors, whether those errors be negative or positive, of omission or of commission.

The first and most evident, as well as the most important considerations in gas management, are the characteristic features of the retort house.

This, in small works, where a single stack of benches is employed, should be 30 feet wide inside, and not less than 20 feet high to the wall plate, covered with a wrought iron truss roof, and slated. The trusses should be 5 feet or 5 feet 6 inches apart, with king posts of such length as to give the rafters a slope of 1 in 2, or say 7 feet 6 inches long for a building of 30 feet clear span. The architectural symmetry of a hipped roof has led to its extensive adoption, but this symmetry is its only recommendation; as in a building 100 by 30 feet, for instance, a hipped roof leaves but 70 feet of longitudinal ridge available for a ventilator, and, in consequence, holds the smoke from the benches at each end of the house, while an ordinary roof permits the ventilator to run the full length of the building. It may here be observed, that the most admirable specimen of a trussed roof and ventilators which the writer has ever seen on a retort house, occurs at the 18th street station of the Manhattan Gas Co., N. Y. city, comprising not only a large central or ridge ventilator, but also wing ventilators along the sides of the roof, at a distance of about two-fifths of the length of the rafters, from the main ridge. The question of ample ventilation has latterly acquired new importance from the disuse of cumbrous and expensive chimney-stalks, and the substitution in their place of a small double-flued chimney to each bench, rising only 3 or 4 feet above the top of the latter. In a line with the centre of each bench, a pair of substantial eye-bolts should be built, one in the back and one in the front wall of the retort house, and at a height of 12 or 14 feet above the floor, the specific purpose of these eye-bolts being to receive the guys of the shear-legs by which the retorts are placed on, or removed from their beds. The very general use of the fire clay renders unnecessary any lengthy allusion to iron retorts, and in this and succeeding articles direct reference is had to the most advantageous treatment of clays.

We now come to the consideration of the benches. These should rest upon a solid foundation of concrete, 12 or 15 inches thick; the top of the ashpan being from 9 to 12 inches below the door sill, between which two levels the floor should run with a continuous slope. For the floor no material is equal to paving brick laid true in carefully rammed sand; stone flagging and iron soon wear smooth, and while the former cracks easily under the heavy charging barrows and cars, the latter becomes intolerably hot. Where "Threes" are used the ordinary clear width of arch is 6 feet 6 inches, with about equal height from the top of the ashpan to the crown of the arch. The intermediate piers (separating the benches) are 1½ brick, say 14 inches thick; and the end piers 2½ brick (23 to 27 ins.) The stack of benches was formerly tied together, both longitudinally and transversely, by round rods of 1¼ ins. diameter, which passed through and were secured to flanch and-rib bench braces; but the transverse tie-rods and their braces are now displaced in new works by double courses of blocks (each 28 by 4½ by 5 ins) laid longitudinally, so as to break-joint, in the centres of the intermediate and end piers of the stack. These double courses of blocks occur at vertical intervals of about 2 feet from centre to centre, and are found to be far more efficient to durable work than the alternative of iron rods, which are speedily rendered useless or destroyed by the high temperature which they experience.

The end braces should have a flanch 6 inches wide and 1 inch thick, and a rib of 1½ inches thick, and 8 inches depth, for Threes, being proportionately heavier for a stack of Fives; it may be asserted, however, that compound or trussed braces would more appropriately and perfectly sustain the enormous strain due to the expansion of the brick work in either case. The braces are firmly secured at bottom by anchor rods, firmly imbedded in the concrete bench foundation, and joined in pairs at top by the rods which run the whole length of the stack, and should be at a hight of 9 ins. above it, so as to permit the circulation of a free current of air.

The expansion of iron retorts is so great as seriously to affect the arches in which they are set, and although the use of clay retorts almost entirely precludes this difficulty, it is of essential importance, in either case, that the range of benches be tied securely in the direction of both its length and depth.

It is an improvement to adopt a square reveal for the reception of the facing wall instead of the old form of a circular arc, turned with a radius 4½ inches greater than the interior face of the bench, and from the same centre, as the square reveal does away with much of the cutting and shaping of brick, which was formerly necessary in carrying up the facing. The projection should be protected and supported by a bar of 4½x1 in. iron, of sufficient length to lap about 3 inches at each end on the piers.

Of the setting of a bench of retorts, it may be observed that there is no department of gas management which more nearly concerns the prosperity of a company. Be the material employed ever so rich, be the mains ever so tight, be the financial administration ever so prudent, the operation of these auxillary *desiderata* may be completely paralyzed by low heats. Most gas makers have, at one time or another in their career, been bestridden by this "old man of the sea," and can remember their buoyancy and relief when an improvement in their settings has brought their retorts to a bright cherry-red, or it may be, to an incipient white. High, uniform and manageable heats must be secured, to which end my first advice to beginners in gas making is: "Make no experiments." If any such are troubled with low heats, let them procure from some one of the larger companies the tracing of a reliable setting, and adhere rigidly to that path which a more matured experience has pronounced the correct one. In saying this, I may be accused of an attempt to trammel original talent; but talent, misdirected, or without the guidance of experience, is not unfrequently a very *ignis fatuus* to its possessor.

In bench-setting it is advisable to employ but one man, or set of men, and to teach them to work to plans accurately, carefully and understandingly. They should not be permitted to assume the responsibility of any deviation from the working drawings before them, upon which drawings, by the way, should be distinctly specified, *in figures*, every dimension of every part of the setting.

Common brick may be used in putting in the filling, up to within one course of the bottom flues, excepting the front course and those around the ashpit—these should be of fire brick. This filling should be 1 inch clear of the piers and back wall all around, and carried up in blocks of about 4 feet in plan, with similar interstices between them; all these interstices should communicate with each other, and with two small openings through the front wall (say 3x2½ ins.) one on each side of the bench and next the pier, and one course above the floor line. These connecting spaces not only allow room for the expansion of the filling, but also afford means of exit for the vaporized moisture. In fire work the closest and most uniform joints are necessary, but simply impossible if fire brick be laid without selection; as they come from the makers they are of varying thickness, because whatever the uniformity of the press, they are of different moisture, and subsequently exposed to different temperatures in the kiln. It has been suggested to plane or grind every brick down to a mathematically uniform thickness, and so secure close and perfect work. In theory this advice is admirable, but it is a refinement of practice only possible in the largest works, if at all, while its aim is sufficiently secured by providing the retort-setter with a couple of guages with which to sort the fire brick for the furnace, into three classes as to thickness, small, medium and large, and instructing him to run each full course around the fire-bag, with bricks of a single class. In the remainder of the setting such nicety is not necessary as is demanded by the intense and scorching heat of the furnace. The whole of the filling proper should be of common brick, laid in lime mortar, except the course which forms the bottom of the lower flues, which being directly exposed to the heat, should be of fire brick, laid in fire mortar. The whole of the facing wall and the first three courses next above the ashpan which support the grate bearers, are also laid in lime mortar, but must be of fire brick. The fire brick should be thoroughly wet before being laid, and in carrying up the furnace, each brick should be driven separately home with a mallet or similar suitable instrument until the thickness of the joint is next to nothing; they should be laid in mortar composed of three parts fire clay and one of ground fire brick, mixed very thin, and carefully run through a fine sieve after being mixed. It is a matter of debate whether pure clay is not preferable to any admixture of ground brick. The face of the bench may advantageously have a batter of three inches from the floor line to the bed of the bottom retorts, thus increasing the tendency of the fuanace doors to close and remain closed. Specific reference will be had to the most advantageous construction of the furnace in a succeeding number of the American Gas-Light Journal.

The London Tunnel Line Declared Not Unhealthy.

In order to quiet the alarm created in the minds of the people in London as to the reported unhealthiness of the tunnel line the Metropolitan directors adopted the sensible plan of employing Dr. Bachhoffner, Dr. Letheby and Dr. Whitmore, the medical officer of health and chemical examiner of gas for the parish of St. Marylebone, "to report on the sanitary condition in general of the stations and tunnels." The following is the result of their investigations:

They obtained samples of the air in the tunnels, 1st, after the trains had ceased running at night; 2nd, just before they commenced running in the morning; and 3rd, in the afternoon, when there is the largest amount of traffic. Twenty-eight samples were taken at different places and altitudes. These samples were analyzed for the detection of everything that could be injurious to health. They were unable to detect the presence of sulphuric acid, even by the most delicate chemical test, which is capable of showing one part in 100,000 parts of air. The proportion of carbonic acid was, on an average, not more than the usual proportion in large towns, and in the worse samples was half and often one-fourth the quantity found in theatres, law courts and barracks. The amount of oxygen in the air of the tunnels was in no case deficient.

As to the effects produced by the combustion of fuel, the practice is to raise the steam in the boiler in the open air to a temperature and pressure which is sufficient to work the trains through the tunnels, and when the trains come into the open space fresh steam is generated sufficient to propel the trains through the next journey; by these means the driver is enabled, when passing through the tunnels and stations, to close the fire-box and damper. The coke is of a superior quality, specially selected and examined before being used.

That disagreeable smells sometimes occur in the tunnels cannot be denied, but these, according to the eminent chemists reporting, are due to the presence of sulphurous acid gas in very minute quantities, much too small to be dangerous; but "one part in 100,000 of this gas is perceptible to both taste and smell; paper moistened with a solution of iodic acid and starch becomes tinged with a blue color when exposed for a few minutes to air having the above proportion of sulphurous acid." A pungent smell also arises from the partial combustion of the wood forming the breaks, when acting upon the tires of the wheels in checking the speed of the train as it approaches the stations. It is an important fact that the men employed underground are less subject to death and sickness than those employed by the Great Western aboveground.

A Sonnet for the New Year.

Ring out the Joy Bells! a New Year is born!
  Welcome him gladly and clothe him in white;
Pile up the yule log; blow trumpet and horn;
  Hail him with music and crown him with light!
Fair be his welcome and hearty his greeting;
  Mirth, love, and jollity join hand-in-hand;
Shout and be merry while Old Time is fleeting;
  Ring out the Joy bells all over the land!
The Old Year is dead; let us honor his ashes,
  Right merrily died he 'mid gayeties fair;
So, while laughter is loudest, and merriment flashes,
  With dance and with music we'll welcome his heir!
Clang go the cymbals, and brave sounds the horn!
  Ring out the Joy Bells! a New Year is born!

MISCELLANY.

THE OLD YEAR AND THE NEW;

OR,

THOUGHTS IN DREAMLAND.

Wildly and mournfully wailed the angry blast as it stripped the yellow and golden leaves from the quivering branches of the nodding trees, scattering them in confused and whirling masses broadcast over the bleak and dreary landscape. Slowly and majestically, the King of Day rode down the western sky in his chariot of fire, dark piles of murky clouds frowning upon his retiring path.

Up rose the Empress of the Heavens with silvery smiles to greet the coming of the goddess Night, whose mantle blue is decked with glittering stars, and when she whispered, "Peace to all the world," I leaned my throbbing brow upon my hand, while angels bore my spirit noiselessly away, to wander for a while in glorious dreamland.

Beneath a giant tree I sat me down, where shimmering waters murmured at my feet, where beauteous flowers shed soft, delicious fragrance on the cooling air, and music stole from many a shady bower, deliciously enchanting. Gay throngs of white-robed fairies wandered over the grassy plain.

The lion and the lamb together played before me, and Love and Peace did seem to blend in unison together "This is not earth," I cried—and fairy voices whispered, "Earth is far away; this is the abode of Time." Then all was still again save the sweet music I had heard before. As if by magic moved, a chariot came rolling over the plain—without steeds, impelled onward steadily, containing but one occupant; and he, a gray-haired, frightful being, an hour glass shaking in his bony hand, and eyes and cheeks deep sunken. Then fairy voices sang a sad, sad song, the wild strain ending, "Hail to old King Time!" Chained to Time's chariot wheels a cowering wretch I saw, with tattered garb and abject mein; and while I wondered who he was, the fairies sang, "It is the poor Old Year."

"Where hast thou been?" I asked, "and wherefore art thou thus cast down with grief and woe? Tell me, thou poor Old Year, why art thou chained and dragged a captive thus from earth away?"

"The days of every year are numbered," he replied, "and when Time bids us follow him, we go as man does when *his* summons comes from the grim King of Terror—Death."

"What hast thou seen on earth?"

"I've seen the seasons come and go; Winter, clad in its mantle white of snow; Spring, with its budding trees and flowers, its smiles and tears; Summer, arrayed in all her gorgeous robes, and Autumn, in her livery of purple and gold, sad, but most beautiful to gaze upon. I've seen the infant open its wondering eyes on Life—births, bridals, death and the grave."

"And is this all?" I asked; hast thou not beheld more than this on earth?"

"Tell him of *all* thou'st seen," cried old King Time, "and I will chain my chariot wheels a while that he may hear; for mortals wandering in the fairy land of dreams heed not the unending flight of hours. Thou dying year speak unto him!"

Thus ordered, the trembling captive said in mournful tones:

"I've seen the ministers of God in far off distant lands, preaching the gospel of their Lord and Master unto the heathen who bow down to worship images of wood and stone—and angels smiled upon them, for their's was the language of Love and Peace.

"I've seen the mighty monarchs of the earth striving to increase their waning power by cunningly devised marriages among each other's offspring, where Love was not—and devils smiled, for the goddess of Liberty was sad.

"I saw a nation fast becoming enlightened, and making slow but steady marches in the path of republican liberty, like unto another *mightier nation* whose starry banner, like a beacon light, guides to its shores the exiled and oppressed of every land. And then a usurping tyrant, who had no right to wield the sceptre that he held, sent his armed hosts among them to crush out liberty and light, to check the onward march of freedom, to bind them with the clanking chains of slavery. Satan himself did grin and clap his hands, while the dark shades of Hades echoed and re-echoed with demoniac shouts, *Vive la Napoleon!* * * * * I saw another nation stretch their hands to God and cry aloud for glorious liberty, and a great bear came among them, killing the people until the land ran red with blood; and then the angels wept, for they, though few, were brave. * * * * I saw a savage and revengeful beast, in form much like a lion, and gray-haired men, the sages of Britannia's realm, led by a Christian woman, did goad him on to desolate a bright 'Green Isle;' to drive its people from the face of the earth, to crush and starve them all, and blight the shamrock in its budding glory."

Here did the Old Year pause, and one pale fairy, clad in faded green, came forth from a dark grove, and she sang a mournful song, her fingers wandered o'er a harp's discordant strings, and dismal was the music that she made.

When the sad strains had died away I saw the other fairies were in tears, and old King Time gazed thoughtfully upon the hour glass in his hand. Again the Old Year spoke, and bitter were the tones of his voice:

"I saw another land, that *freemen* love, because it was purchased with the blood of patriots slain. There Liberty's proud temple was upreared in mighty grandeur, and from its cloud-capped cupola the fairest flag in all the world did float defiance in the breeze—the unsullied flag of stars—the blood-bought banner of the free. And as I gazed, unnumbered voices rent the air—

"Conquer we must, for our cause it is just,
And this be our motto, 'In God is our trust;'
And the Star Spangle Banner in triumph shall wave
O'er the land of the free, and the home of the brave."

"And while the people sang the heavens were opened, and light shone down from above, gilding the cloud-capped cupola of Liberty's temple like a halo of glory.

"I am dying," murmured the Old Year, "and my successor cometh now to reign in my stead. May he bring you happiness and peace. May your land be blessed. May its people soon be united and prosperous, joining their hands in true friendship over the graves of your fallen heroes. May the tears of the widow and orphan be dried, and Columbia become the admiration of the world. God bless you all, and to all a Happy New Year."

Time's chariot moved on, dragging the dying captive from my sight. The snow fell thick and fast, while onward came the New Year, clad in his glittering robes. His icy breath I felt upon my burning brow, and shivering I hastened from his path. Chilled with the cold I woke. My lamp burned low—the firs was smoldering in the grate—and the dull ticking of the clock was all the sound I heard. I knelt down by my chair and prayed—then sought my couch to rest, murmuring, "A Happy New Year to all, and to all good-night!"

American Antiquities.—Between the Colorado river and California range of mountains is a vast desert, which, nevertheless, bears evidence of having once been thickly populated. Humboldt, during his researches on this continent, discovered abundant vestages of a race more civilized and cultivated than any which occupied the country on its first discovery by Europeans. Recently a party of adventurers ascended the Colorado for a distance of about two hundred miles. They found the country on both banks destitute of vegetation, level and monotonous. On one of the plains they discovered an object, which, after a tramp of five miles they reached, and found a pyramid of stone laid in regular courses, and rising over 100 feet from the plain, the top presenting a surface of 50 feet square. Evidently a portion of the top had been dislodged, either by the hands of men or some convulsion of nature. The courses of stone were from eighteen inches to three feet in thickness; the outer courses cut out at an angle corresponding to the inclination of the structure. The abrading action of the elements had so worn the joints that the ascent was the work of but little labor. By whom and when this pyramid was built will probably always remain a mystery.

General Summary.

[Compiled for the American Gas-Light Journal.]

A Diamond Mine in California.—We learn from a California paper that George W. Cox, an old resident of El Dorado, has discovered a veritable diamond mine near that place. The stones are said to be beautiful and peculiar, for one of which he was offered $100. He intends testing them to ascertain if they really are diamonds.

Carburetted Gas.—The San Francisco *Daily Call* is in extacies at this improvement in gas light. It says: "The invention has been tried in our printing room with success. Using ordinary city gas the consumption for one meter in the printing room, for one week, was 2,300 feet, or 383 feet per night; for the following week it was 2,100 feet, or 350 feet per night. The carburettor was then attached, and during one week the consumption was only 1,200 feet of gas, or 200 feet per night, being a saving on the bill for that week of 43 per cent. Though much less gas was consumed, the printers say their light was better than before. This trial fully demonstrates, in our opinion, the fact that the carburettor will save a large sum to gas consumers, besides affording them a better light."

Water Works in San Francisco.—We learn that works of an expensive nature are being carried on by the Oakland Water Company. Clear pure water, obtained from the Beideman Rancho, about five miles distant from the city, now flows into Oakland, and the supply is abundant for all wants at present. A large reservoir is to be dug on an elevation which it is said will be capable of forcing the water into the upper stories of the highest houses that may be built.

Another Water Enterprise in San Francisco.—A company has been incorporated in Los Angeles, San Francisco, with a capital stock of $250,000, divided into two thousand five hundred shares, to collect during the winter season the surplus water of the Los Angeles river, and retain it in reservoirs for use during the summer months. The company propose to build a dam at the mouth of a canon a few miles west of the city, by means of which a reservoir of about six hundred acres in extent will be formed, and into this the river will be turned through a cut or tunnel. It is expected that the supply from this source will be amply sufficient for all purposes.

A California Invention.—Mr. George E. Graves, of California, has invented a submarine respirator, which, if it meets the expectation of the inventor, will enable any person not naturally afraid of the water to go overboard at a minute's notice and remain under water for an indefinite period of time, or for as long a time as he could breathe through the mouth with the nostrils closed above water.

The Chicago Tunnel.—The tunnel under the Chicago river is again under way with every chance of a thorough and successful prosecution of the work. It is under the management of Mr. Chesbrough, City Engineer for Chicago, and originator of the famous Lake Tunnel, as well as the plan for raising the entire city, which has been so successfully carried out. The bottom of the tunnel, or top of invert in the middle of the river, is to be 32·4 feet below low water. The length of tunnel will be 838 feet, with open approaches of 770 feet in all. The tunnel under the river is to consist of three passage-ways, one ten feet wide for foot passengers, the others eleven feet each, for vehicles.

Petroleum vs. Coal—A successful experiment was made recently on the Ohio river, with petroleum as a substitute for coal in navigation. The advantages of this arrangement, says the Cincinnati *Gazette*, are obvious. First, we have the economy of the fuel itself, twenty dollars worth of petroleum being worth fifty dollars worth of coal. Then there is the economy of weight and space, which is as two to ten. In addition to this, we have the saving of wages of firemen and coal heavers, the saving of time in taking the fuel on board and above all, the perfect control of the engineer over the fire, and the complete absence of any danger from sparks.

PATENT CLAIMS.

Pertaining to Gas, Mining, Petroleum, Water, etc.

70,701.—Brackets for Lamps.—Robert Deveroux, of Buffalo, N. Y., assignor to himself and Bernard H. Muehle, of the same place.

I claim the circular rim, A, having an opening, D, for the purpose and substantially as herein set forth and described.

70,712.—Apparatus for Burning Hydrocarbon Oils—Matthew D. Gosnell, of Baltimore, Md.

I claim the combination and arrangement of a tube or pipes, B B, a perforated hearth, C, a valve or valves or inlets for admission of atmospheric air, D D, with a boiler, A, and furnace, B, or their equivalents, in the manner and for the purpose set forth.

70,746.—Steam-Generators.—Robert E. Rogers and James Black, of Philadelphia, Pa.

We claim the boiler, A, having the enlargment *a* formed so as to project at or about a right angle with the body of the boiler, in combination with the circulating tubes, B, when the upper ends of said tubes are inserted straight into the enlargement *a* and the lower ends of said tubes are bent and inserted into the lower portion of the body of the boiler, A, substantially as set forth.

70,809.—Apparatus for Carburetting Air.—William F. Cozzens and J. H. Jones, of St. Louis, Mo., assignors to themselves and Leopold Bouvier, of the same place.

We claim, 1. The combination of the condensing or forcing apparatus, A, with the carburetter, B, substantially as set forth.

2. The combination of the trays, B2 and B3, and the injection pipes, *b5* and apertures *b4*, when arranged as and for the purpose set forth.

Late Mining News.

[Compiled for the American Gas-Light Journal.]

—The sulphurets from the Illinois and Wisconsin mines, Nevada county, are sold from the mill at $115 per ton.

—Ten tons of ore from the Buckeye mine in Summit Canon, North Twin River District, worked in the Twin River Company's mill at Ophir Canon gave a bulk assay of $300 per ton.

—The heaviest dividend of the year on the Comstock was declared on the 6th November, in Gold Hill. The Eclipse Mill and Mining Co. declared a dividend of $150 per share.

—The mines at Como, Palmyra district, are looking up. They are being reopened and work in them prosecuted with energy. Ore from the old dump pile, hauled to Dayton, is yielding over $20 per ton.

—The total amount of bullion shipped from Nevada and Gold Hill, for the week ending November 9th, was 8,409 pounds, worth $214,030 58, and the total amount assayed in the two towns was 97,973 ounces.

—During the past ten months the dividend declared on mines of the Comstock lode have reached the handsome amount of $3,595,706. The chances are that the coming ten months will not compare favorably.

—The Amador Mining Co., located at Sutter Creek, Amador county, formerly known as the Hayward mine, have declared their first dividend of $6 per share, amounting to $22,000, payable on and after the 9th of November.

—Grass Valley can boast of seven opened quartz mines, all of which are paying handsomely at the present time. We include the following: Eureka, North Star, Empire, New York Hill, Illinois, Lucky and Dromedary. Specimens were taken from the latter to the Gold Hill mill to be crushed: one of the pieces was the size of a man's head and estimated to be worth $1000.

—A fabulously rich quartz ledge has been discovered on the dividing line between Trinity and Klamath, by two brothers named Abrams. A moneyed man proposed to put a mill on the ledge for one-sixth interest, but they declined, believing that they can in one month pound out gold enough to buy one.

—The San Andreas *News* says that in a shaft of 150 feet deep on the Bovee claim, in Calaveras county, a deposit of unparalleled richness has been struck. After making a blast the workmen had to pry out the shivered mass of gold and quartz with crowbars, the broken chunks being bound together by threads and strands of gold. It is said to be one of the richest mines ever discovered in California.

—The extraordinary quality of the ore which the Dana mine, Reese River district, is producing excites general surprise. One lot of four and a half tons yielded at the rate of $842 per ton; another lot of three tons yielded $844 per ton. The second class ore, of which this mine yields largely, is also of superior quality, working upward of $200 per ton. It must be classed among the richest mines of Reese River.

—The Savage Silver Mining Co. of Nevada (Comstock Lode) after paying dividends for the past year to the amount of $1,200,000 in coin, leaving a balance in hand of $149,201, having the satisfaction of knowing that the reserves of "ore in sight" are estimated at 100,000 tons. The amount of interest paid during the year has been equivalent to 10 per cent. on a valuation of the shares at $14,000 coin per lineal foot.

Useful Recipes.

To Preserve Flowers in Water.—Mix a little carbonate, or nitrate of soda, in the water, and it will keep the flowers a fortnight.

To Imitate Ground Glass.—If one ounce of powdered tragacanth in the white of six eggs well beaten be applied to a window, it will prevent the rays of the sun from penetrating.

To Varnish Drawings.—Take one ounce of Canada balsam and two ounces spirits of turpentine. Size the drawing with a solution of isinglass in water, and when dry apply the varnish with a camel's hair brush.

To Clean Gilt Frames.—Beat up three ounces white of eggs with one ounce of soda. Blow the dust off then rub them over with a soft brush dipped in the mixture and they will become bright.

For Frosted Feet.—Mix Indian meal to the consistency of paste with cold water or milk and apply speedily. Renew the application when it becomes dry, and continue until relieved.

Volatile Soap for Removing Paint, Grease Spots' etc.—Take four table spoonful spirits of hartshorn, four table spoonful alcohol, and one table spoonful salt. Shake well together, and apply with a sponge or brush.

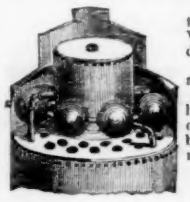
Chapped Hands and Lips.—Take one ounce glycerine, add fifteen grains tannin, shake thoroughly and it will soon dissolve. Apply to the chapped surface twice a day. A few applications will effect a cure.

To Renovate Manuscripts.—Take a hair pencil and wash the part which has been effaced with a solution of prussiate of potash in water, and the writing will again appear, if the paper has not been destroyed.

Gold Varnish.—Pulverize one drachm saffron and half drachm dragon's blood, put them in a pint spirits of wine, add two ounces shellac and two drachms soccatrine aloes. Dissolve the whole by a gentle heat. Yellow painted work varnished with this mixture will appear almost equal to gold.

Whitewash that will not Rub Off.—Slake the lime in the usual way. Mix one gill of flour with a little cold water, taking care to beat out all the lumps, then pour on boiling water enough to thicken it to the consistency of common starch when boiled for use. Pour it while hot into a bucket of the slaked lime, and add one pound of whitening. Stir all well together. A little "blue water," made by squeezing the indigo bag, or a little pulverized indigo mixed with water will be an improvement.

DAVIS' PATENT SAFETY Steam Superheating Boiler,



Requires only 25 lbs. of coal per day to the horse-power. Are made of the VERY BEST IRON, double lapped and double riveted.

Being upright, occupy little space, and are easily cleaned.

Without additional fuel, the Superheater increases the working capacity of the steam 25 per cent., which has been fully demonstrated by the many now in use. (See illustrated circulars). Address the

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First quality Scotch Union Jets, Improved Cylinder Burners, Plyers and Burner Pillars. Burner Tips made to order. [876m.

GAYLORD'S PATENT COUPLINGS,

Fig 3

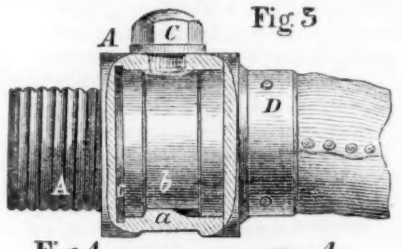


Fig 4

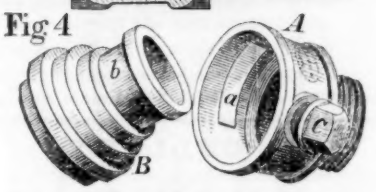
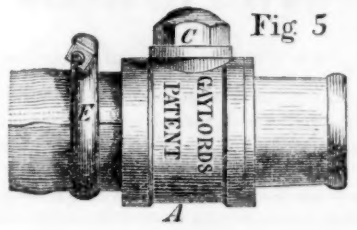


Fig 5



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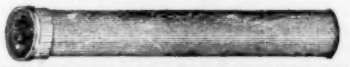

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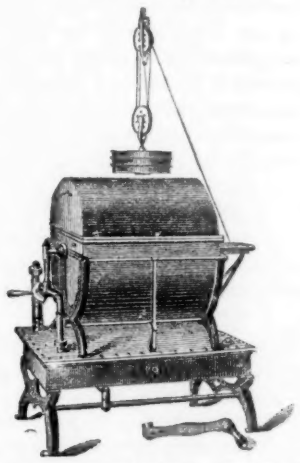

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MESSRS. O. P. DRAKE & CO., BOSTON:

Gentlemen: In answer to your inquiry, I will say that I had your Gas Machine in use about nine months, manufacturing gas for lighting my store. It gives me but very little trouble. The light is good, clear, and at all times reliable. Its cost is less than half the cost of street gas. As regards safety, I think it very much safer than Kerosene lights.

Yours respectfully,
WM. C. BARNES.

BOSTON, Aug. 22, 1867.

MESSRS. O. P. DRAKE & CO., 8 Bedford-st., Boston:

Gentlemen: I purchased of you, Nov. 18, 1865, one of your Solar Gas Machines, for my house at Auburndale; and from that time until the present, I have enjoyed uninterrupted success with it. The light is uniform, clear and steady, and the best I have ever seen. I have never experienced trouble of any nature from the machine, and consider it invaluable. As to its safety as compared with any other illuminator, I consider it far superior, and have discarded everything else in the shape of oil, fluid, kerosene, etc. Hoping your invention may prove remunerative, I remain,

Yours respectfully
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53 Merchants' Exchange.

LAKE FOREST, ILL., Aug. 30, 1867.

CHAS. MATTHEWS, ESQ., Agt of Drake's Solar Gas Mach., Chicago:

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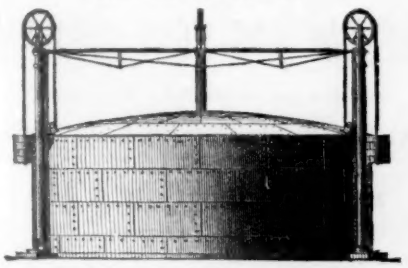

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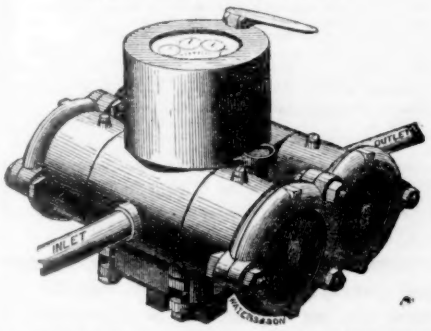

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Published on the 2d and 16th of Each Month

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M. L. CALLENDER & CO.,

EDITORS AND PROPRIETORS.

THURSDAY, JANUARY 2, 1868.

WISHING TO MAKE this Journal an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of those subjects a pleasure, or a profession.

SUBSCRIBERS would confer a favor upon us by remitting CHECKS or POST OFFICE MONEY ORDERS, as we are frequent losers where money is enclosed in letters.

☞ NEWS AGENCY.—The American News Company, 119 and 121 Nassau street, New York, are agents for this Journal. Newsdealers will please send orders to them.

CONTENTS

Root's Trunk Engine	193	cisco	197
Coating Iron or Steel with Copper	194	Another Water Enterprise in San Francisco	197
Purification of Gas	194	A California Invention	197
Pleasures of Reading	194	The Chicago Tunnell	197
More Water for San Francisco	195	Petroleum vs. Coal	197
People's Gas-Light Co	195	PATENT CLAIMS	198
Practical Management of Gas Works	196	Late Mining News	198
The London Tunnel Not Unhealthy	196	Useful Recipes	198
Poetry—A Sonnet for the New Year	197	Answers to Correspondents	200
MISCELLANY—		EDITORIALS—	
The Old Year and the New	197	Convention of Gas Engineers	200
GENERAL SUMMARY—		Hints to Gas Fitters and Consumers	200
A Diamond Mine in Cal	197	Items About Gas Works	201
Carburetted Gas	197	Erratum	201
Water Works in San Fran-	197	Collin ' Patent Lamp	208
		Miscellaneous Items	208

☞ Owing to a change in the ownership of this Journal, the firm will hereafter be known as M. L. CALLENDER & Co.

Answers To Correspondents.

P. G., of Mass.—Pewter is composed of tin 100 parts, antimony 8 parts, copper 4 parts, bismuth 1 part. Fuse the copper first, then add the other metals and stir well when fusing. Cheap pewter is composed of four parts tin and one part lead.

L. V., of Cal.—We shall always be pleased to receive articles either from scientific men or mechanics, in relation to any subject which they have made their special study. The ideas should be expressed in the simplest style, and fewest possible words.

T. H. C., of Ohio.—We have but little knowledge in the art of numismatics. Greenbacks seem to have enhanced the value and rarity of all coins, both ancient and modern, until all have become a curiosity. The silver dollar of 1804 was not sold for $1,000. We cannot inform you what your U. S. silver dollar of 1798 will bring in market. Perhaps some reader of this will make you a bid.

N. L., of Ill.—Naphtha and turpentine will dissolve India-rubber and gutta percha to form a cement useful to put upon the soles of boots and shoes to make them water proof. Cut the rubber into thin shreds, place it in the naphtha, and stir it frequently till it is dissolved; a gentle heat may be employed. The rubber must not be vulcanized, but pure. Benzole, spirits of turpentine, and bisulphide of carbon are also solvents of India-rubber and gutta-percha.

S. A. T., of Pa.—Sulphuretted hydrogen may be obtained by adding some sulphuret of iron to dilute muriatic acid; bubbles will arise and may be collected in a receiver over a water bath as usual.

O. B., of Ohio.—If you pass a charge of electricity from a Leyden jar through your induction coil, a spark will be produced at the outer extremities of the coil, the same as a current from a voltaic battery. Of course the charge of electricity must be of sufficient intensity to overcome the resistance of the coil.

CONVENTION OF GAS ENGINEERS.

It is a matter of surprise to us that gas engineers and superintendents throughout the United States have not, years ago, entered into some kind of an organized association for their mutual benefit and advantage. Every other profession, trade and calling have their regularly constituted societies, and have periodical or special conventions, where all of similar tastes can meet together for their mutual advantage and pleasure, we may add; for what can be more pleasurable to different members of any profession than to meet and exchange social civilities and at the same time exchange, elucidate and develop the various ideas, views and questions belonging to their peculiar specialty?

Merchants, ministers, physicians, artists, political parties and temperance men, etc., have each their special organizations, and at the present time the financial success and general advancement of almost every branch of industry, of science or art, depends upon the completeness and extent of its organizations, and a combination of the various lo al interests to promote the general good.

The gas interests of this country are immense at the present day, involving many millions of capital, and the branches of industry arising from it have an importance, when taken together with the primary element, not to be despised in the general estimate of the wealth of the country.

Our valued correspondent, "R," in the issue of this Journal of the 16th of November last, treats this subject in so clear and convincing a manner, that we are constrained to quote. Speaking of the necessity of having a convention at some central point, where all could assemble and organize an association to meet annually for mutual advantage, he says:

"This is no new thing; in England, and we judge elsewhere, we read of such meetings being frequently held, to hear interesting and valuable lectures on the various highly important matters which *should* claim the attention of every gas engineer and superintendent.

"The various mooted points in regard to clay and iron retorts; the adaptability of clay retorts as well to small as large works; the best methods of removing the accumulation of carbon without injury to the retorts, stopping leaks, etc., could be discussed; the comparison of the percentage of yield; proportions of coke used in carbonization; relative length of time retorts will last; quality of the gas produced under photometric test between clay and iron retorts; also whether, as tar is becoming so valuable a product of gas works and coke so desirable a substitute for the dirty bituminous coals as a fuel, it would not be better to use iron retorts, as the yield of these residuums is more abundant in the one case than the other.

"Again, the questions whether the practical advantage of naphtha and other hydrocarbons applied between the company and the consumer are important; whether the passage of steam over carbon, thereby generating hydrogen gas, which could be separately used for the purposes of heating, or injected into the retorts in which coals are being carbonized, thereby supplying material for the surplus olefiant gas to enter into combination therewith, thus producing a largely increased yield of carburetted hydrogen from the same weight of coals, instead of depositing (as is claimed) the excess of olefiant gas on the retorts in the shape of carbon, would be a matter for deliberation.

"Other subjects for consideration would be to determine by scientific investigation, the simplest and most effective plan for setting retorts, whereby the greatest amount of heat, with the least consumption of fuel, to produce *certain* results from a given quantity of coals, could be reached; the best means of detecting impurities in gas; the mode of applying the various tests; the best methods and apparatus for washing and condensing gas; the necessity of an exhauster when using clay retorts, in small as in large works, etc., etc.

"Questions in regard to coals—from whence the best can be obtained, their quality and yield with a variety of other interesting subjects which could be presented for consideration, and would arouse inquiries which would prove of incalculable advantage and would raise the profession to a high point of excellence in practical and scientific knowledge.

"At the annual meetings the different manufacturers of meters and other requisite machinery for gas-works, could have samples of their machines on exhibition, showing the exactness of their operations; the mechanical and scientific skill required for their construction; specimens of the quality of the materials of which they are made, and demonstrating by actual test which meter would, under the lowest pressure, accurately register the smallest amount of gas passing through in a given time.

"A few weeks ago we took occasion to visit some of our neighboring gas engineers and superintendents, when the reciprocal pleasure each experienced in the society of the other, the hearty good will expressed, the willingness to impart all desired information, produced such an agreeable feeling of satisfaction, that we have no doubt that such a meeting as that suggested would be heartily responded to, result in much good to all concerned, and be of immense advantage to the profession, as well as to the gas companies with which they are severally connected.

"To present the matter to the consideration of the profession, we would suggest that such a convention be held in the city of Cincinnati in the middle of April, May or June of next year. That is a period when, as a general thing, gas works are over their serious work, when plans and arrangements are being perfected for the needed enlargements and changes required before another season of heavy work."

In conclusion, we desire to say that it would afford us pleasure to promote this movement as far as we are able; and we cordially invite every gas company and others interested in the subject to endorse the proposition by letter, addressed to the Editors of the AMERICAN GAS-LIGHT JOURNAL, 22 Pine-street, New York.

HINTS TO GAS FITTERS AND CONSUMERS.

The subject of artificial light, owing to its great importance and advantage to the public, is one of the most interesting studies. When we consider that our great luminary, the Sun, gives us light only eight hours per day in some parts of the year, the production of a good artificial light may be compared with the prolonging the pleasures of life one-third, which would otherwise be lost in total darkness.

It wonderfully enhances our daily comforts, and facilitates and increases our industries, and it serves to regenerate mankind from barbarism and brutality, elevating him to the perfection of enlightenment and civilization.

In consideration of the evils that constantly arise by the ignorance and carelessness of persons engaged in the introduction of gas, or who have charge of gas-light, we trust any endeavor to simplify and elucidate its principles will not only be acceptable to the practical workman, but to the consumer, and to all persons who find pleasure in obtaining useful information.

HEATING POWER.

The comparative value of gas with other species of fuel has been determined, by finding how much of each is required to melt a given quantity of ice in a given time; thus, one pound of hydrogen gas will melt 370 pounds of ice; good coal will melt 91 pounds; coke, 93 pounds; culm, 46 pounds; charcoal, 95 pounds; wood, 91 pounds; and peat, 19 pounds.

MANAGEMENT OF GAS FITTINGS.

The best material for gas fittings is iron, both for strength and durability; it is less acted upon by gas than almost any other commercial metal.

The gas should be introduced through pipes of sufficient capacity to admit a good supply when all the lights are burning together, and at that period of the evening when the greatest quantity of gas is consumed, which is generally from 7 to 10 o'clock. Local situation will have to be taken into consideration, because those consumers who are upon rising ground, or in the upper stories of high buildings, have a stronger pressure, owing to the levity or ascending power of the gas. It is better to have the pipes too large than too small; the difference in cost is a trifle, and the consumer can at any time add to

his lights, without any change in the original arrangement of the fittings.

OSCILLATING LIGHTS—OBSTRUCTIONS.

The pipes should always, when it is practicable, have a slight inclination toward the meter, or where the main cock is situated, and thence to the street main, so as to conduct away and drain off any water or other material that may condence in the pipes. When not thus arranged, the accumulation of water in curves or depressions will frequently cause an oscillation, or as it is termed, a jumping of the lights producing serious inconvenience.

In such cases the location of the obstruction may, be found by observing the lights in succession approaching the main till they burn steadily. If all the lights vibrate, then observe the adjoining neighbors' lights, and if they are steady, the cause will be in the service pipe leading from the street main.

In case it is impossible to incline the pipes toward the street main, the lowest point must be fitted with what is usually, but improperly, termed a siphon, which is a short tube or drip-pipe with a stop-cock near its lower extremity. At this point the condensed matter may be drawn off as occasion requires.

IMPERFECT FITTINGS—LEAKS, ETC.

There is no greater nuisance than imperfect or leaky fittings. When leaks exist no time should be lost in searching for and remedying the evil. It is not only unpleasant and wasteful, but dangerous to health and property to neglect a leak, however small.

Leaks may be temporarily stopped simply and expeditiously, with thick tape or strips of stout linen or cotton cloth, thickly smeared with white or red lead and bound tightly over the defective place. In private houses and elsewhere, where it can be done without inconvenience, it is advisable to turn off the main cock at night when the light is not required. Stop-cocks may be introduced advantageously to shut off the gas from certain portions of a building only, while, if necessary, vestibules, entrys, nurseries and bed rooms may continue lighted, or in a condition to be lighted.

(To be continued.)

ITEMS ABOUT GAS WORKS.

WATERTOWN, WIS.

We learn that Mr. Chas. Collier and Mr. William Livsey have remodeled the gas works in that city, which are now running nicely. The works were abandoned by the old company, and had remained idle about two years. These enterprising gentlemen have now started with 107 consumers, burning about 8,000 feet per night, at $4.50 per M. Two miles of cast iron main have been relaid, and in the Spring one mile more of main pipe will be laid, which will increase the number of consumers to about 200.

BLOOMINGTON, ILL.

These works are now running successfully, having been repaired and fitted with a set of new clay retorts manufactured by Messrs. Hambleton & Green of the Laclede Fire Brick Works, St. Louis, Mo. Mr. C. W. Douty, son of G. Douty, of the Columbus gas works, Ohio, has recently taken charge of the Bloomington works.

LE ROY, N. Y.

Mr. Gideon Fordham, superintendent of these works, is desirous to obtain more definite information how to obtain the results in working with high heats, mentioned in a former number by our correspondent "OUT WEST." This is one of several enquiries of a similar nature. Perhaps "OUT WEST" will accomodate them all, through our columns, which are always open to him and to others who wish to elucidate this or other subjects with which they are familiar, either upon gas, science or mechanics, etc.

☞ It is with some hesitation that we propose to reprint the articles upon the Management of Gas Works. It is a procedure somewhat unusual in itself, but warranted—as we venture to hope—by former comment of a kindly nature, and by the desire of their author to correct past crudities before completing the series.

The appeal which the present article makes to the courtesy of gas engineers, and its request for their unsparing criticism, go far to prove the sincerity of its spirit; and if this request and this appeal be heeded, the attrition will finally round the successive chapters into a whole sufficiently valuable for publication in book form.

A Hand Book of American Practice is certainly needed. This is the final aim of the articles to which we refer in this.

ERRATUM.—On page 192 of our last issue, in the description given of A. L. Bogart's gas stoves, commencement of the last paragraph, we inadvertently stated, "the patent was granted Nov. 26th, 1847." It should have read Nov. 26th, 1867.

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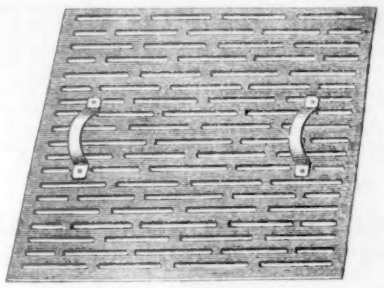

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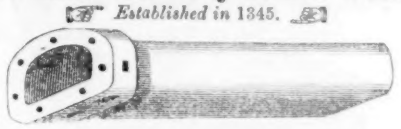

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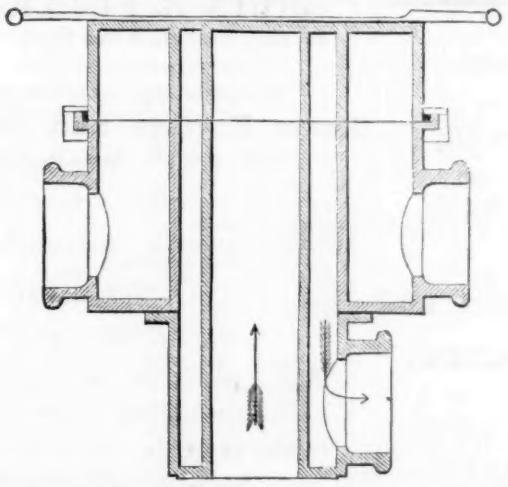

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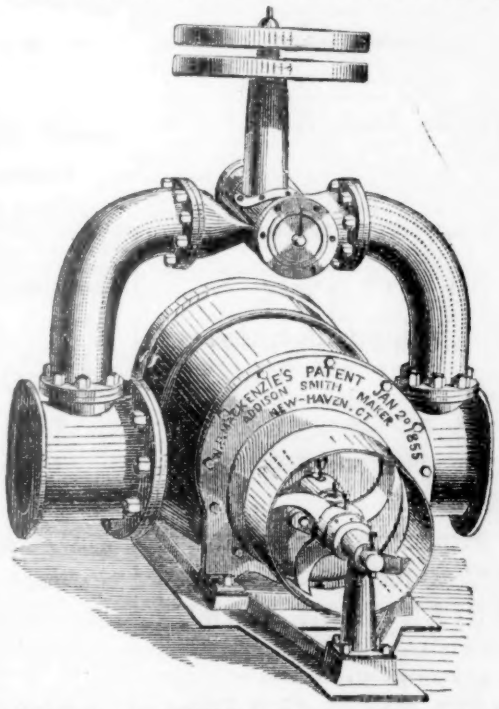

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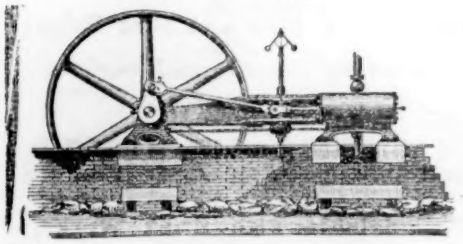

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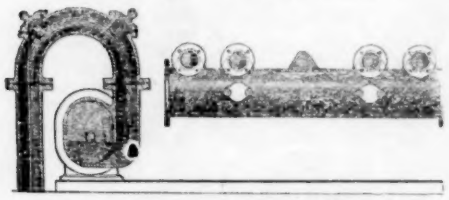

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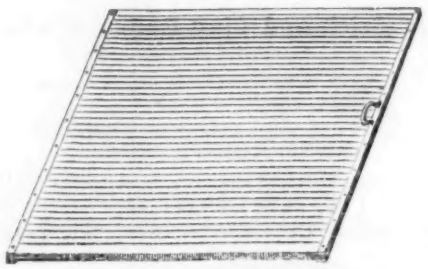

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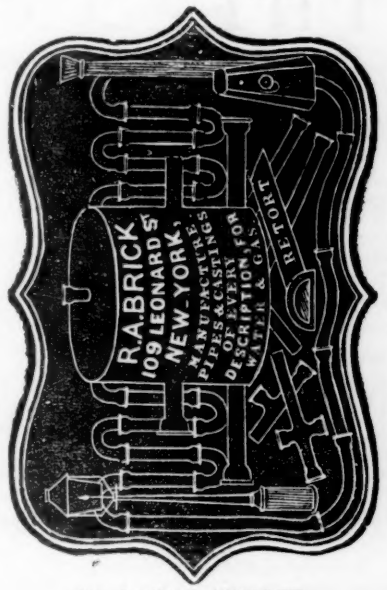

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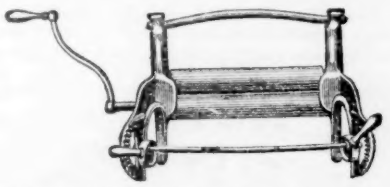

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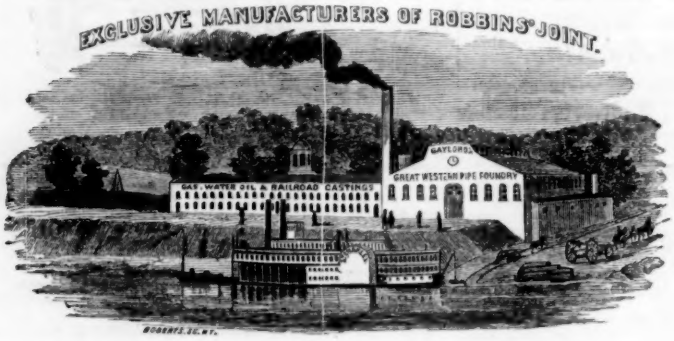

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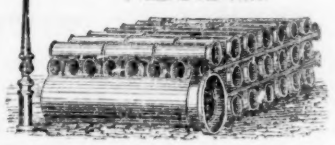

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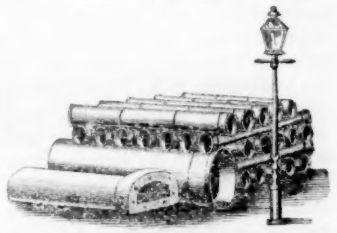

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WHITE LEAD.—An invention has been provisionally specified by M. Bonniville, of Paris, for obtaining white lead direct from the ore, by pouring the molten metal into cold water, to render it as porous as possible; it is then dissolved in sulphuric acid, and the sulphate is treated with pyroligneous or oxalic acid, combined or not with tincal dissolved in water, and next dried over the fire on trays. The vessels employed are either made of stone or wood, lined with lead.

Collins' Patent Lamp.

Among the multitude of improvements in coal-oil lamps which have been brought out since the discovery of petroleum, and its application for illuminating purposes none perhaps have met with so much success with the public as the "COLLINS' PATENT SUN BURNER," as it is called. This lamp is clearly illustrated herewith. It will be observed that the body, or lamp receptacle, is of the usual form; the burner and chimney being the novel feature in the invention. The chimney is broad at the bottom, and slips over the diaphragm or flat cone and rests upon the perforated disc below. The space between the disc and the cone, or diaphragm, being open to give free passage to the light through the base of the chimney, the cone or diaphragm being supported by standards rising from the wick-tube, and has its outer periphery curved and slotted to form an elastic seat against the side of the chimney, while the slots allow air to pass above the cone, sufficient to support combustion, and the perforated disc below gives free ventilation to the base of the flame.

In this manner a simply constructed burner is obtained, and the draft is so arranged, together with the non-conductability of the glass at the base, as to prevent the heating of the top of the lamp, and the generation of gas, making it practically non-explosive. The glass chimney can be easily removed by hand without burning the fingers, as the lower part is always cool. It is said to save one-third of the oil, as no light is hidden below the metallic cone or diaphragm, consequently all the light is obtained due to the combustion, making a clear, white and cheerful illumination.

This really useful and valuable invention seems to meet with remarkable favor, and we understand the patentee, M. H. Collins, is receiving a royalty amounting to $130 a day, which gives some idea of the value of a good improvement in the simple article of a lamp.

Messrs. Fernald & Darrow, No. 69 William street, are general agents for this burner, of whom further information may be obtained.

Miscellaneous Items.

—The San Francisco *Times* says that Mr. George L'Ammoureux, a gentleman who has given much information in regard to the peat deposits of Nevada, states that the Central Pacific Railroad, above the sink of the Humboldt, will run for fifteen miles through a peat bed, with several miles of peat on either side.

—Mr. Wells, the manager of the Singapore Gas Co., in his report to the directors, states that a cargo of coals from Sydney, Australia, had been obtained at a moderate cost, and that the return was 9000 cubic feet of gas per ton, and of good quality, producing also first rate coke.

—The gold yield for the country for 1867 is estimated as follows: Montana, $12,000,000; Idaho, $6,000,000; Oregon, $2,000,000; Colorado, $5,000,000; Nevada, $19,000,000; California, $25,000,000, and miscellaneous $5,000,000. Total, $74,000,000. These estimates are those of Ross Browne in his forthcoming report.

—Great alarm was created in London a short time since, by a report that the underground railway, which is one of the great arteries of traffic in the metropolis, was beset with noxious and explosive gases. At an inquest held on the body of a young girl who had died suddenly in one of the carriages on the line, scientific evidence was produced to prove that the atmosphere in the tunnels was quite innocuous.

—The coal deposits of Russian America are pronounced valueless, the mineral being found only in small contorted seams. Iron is found in worthless beds of clay, and far up on the Konkon gold may be obtained, but under such circumstances that it is also valueless, being only workable two months in the year. Stains of copper have been found on rocks near Norton Bay, but no ledge or seam.

—Prof. Cook, of Harvard College, has constructed a cheap eudiometer, to be used in the lecture-room, as well as laboratory, in which the article called "stopper cord," manufactured by the Boston Belting Company, has been found very serviceable. The stopper cord consists of conical rolls of very elastic rubber, about 4 feet in length, and varying in diameter from one-half an inch at one end to an inch and a half at the other. Stoppers of any diameter between these limits may be cut from the roll and bored with a common brass cock borer, which must be moistened with water to prevent adhesion to the rubber. The stoppers are found to be air-tight under a pressure of 15 lbs. to the inch, provided the contact between the tube and stopper is at least half an inch in length.

—Most of the features of modern steam engineering originated in the fertile brain of James Watt. He found the steam engine in a very crude state and left it in qu te as perfect a condition (except only mechanical construction) as that of the ordinary engines at the present time. He invented separate condensation, expansion, steam jacketing, superheating and the governor. The combination of the governor with a cut-off valve gear was reserved to a later period, having first been published in the *Repertory of Patent Inventions* for 1826, as the invention of James Whitelaw. Since then the steam engine has advanced by improvement in details and construction rather than by the development of new principles.

Advertising Index.

GAS-BURNERS, APPARATUS, ETC.

Arnold's Metallic Gas Trays—T. G. Arnold, 334 and 336 West 21st street, N. Y. 201
American Meter Company, 512 West 22d street, New York ... 206
Automatic Gas Purifier - State Rights for sale—Wm. C. Turnbull, care of T. C. Babcock, 59 Broadway, or office of the AMERICAN GAS-LIGHT JOURNAL 205
Castings, Station Meters, &c.—Wilmington (Del.) Gas Company; G. Richardson, President 204
Cast Iron Pipes and Fittings—B. S. Benson, 52 East Monument street, Baltimore, Md. 198
Glycerin for Wet Gas Meters—Hartmann & Laist, Cincinnati, Ohio, or L. Bruckmann, 67 Wall street, New York 201
Gasoteine,—J. W. Wheelock, 284 Pearl st., New York 202
Gas Coals—Bird, Perkins & Job, 104 Wall street, New York ... 202
Gas Engineers and Contractors—Hoy, Kennedy & Co., 111 Liberty street, New York 202
Gas-Burners—C. Gefrorer, 529 Commerce street, Philadelphia, Pa. 207
Gas Meter Manufacturers—Harris & Bro., 1117 Cherry street, Philadelphia, Pa. 206
Gas Superintendent—C. M. Cresson, 417 Walnut st., Phil., Pa.. 207
Gas Apparatus, &c.—Geo. H. Kitchen & Co., 561 Broadway.. 207
Gas Burners—Wightman Bros., 25 Kilby st., Boston, Mass.... 207
Gas Burners—T. G. Arnold, 224 and 226 West 21st st., N. Y. 207
Gas Burners—W. Anderson, cor Franklin & Elm sts., N. Y....198
Gas Works Fixtures for Sale—Brookline (Mass.) Gas Co..... 204
Gas Works for Sale—Colonel A. J. Sabbaton, Manhattan Gas Works, N. Y. 201
Gas Engineer—James R. Smedberg, 22 Pine street..... 201
Gas Stoves—A. L. Bogart, 792 Broadway 201
Gasworks Apparatus For Sale—Jos. R. Thomas, Wmsburgh Gas Works, N. Y. 199
Metropolitan Gas Stove Co., 702 Broadway, New York 199
Plumbers, Gas and Steam Fitters—Moore & Gaussen, 221 West Fifth street, Cincinnati, O. 202
Patent Gas Exhauster—Smith & Sayre, 484 Broadway..... 208
Patent Dry Centre Valve—American Meter Company, 512 West 22d street, New York..... 203
Purifying Trays—Jno. L Cheeseman, 147 and 149 Ave. C, N.Y. 204
Retorts, Pipes, &c.—R. D. Wood & Co., 400 Chestnut street, Philadelphia 207
Street Lamps—J. G. Miner, Morrisania, Westchester Co., N.Y..199
Solar Gas Machines—Smith & Drake, 726 Broadway..... 199
Second-Hand Purifiers Wanted—Apply at office of this paper.. 204
Wet and Dry Gas Meters, etc.—Joseph Lennig, 1615, 1617 and 1619 Francis street, Philadelphia, Pa. 207

FOUNDRIES.

Bergen Iron Works—Driving Pipes and Bands—R. A. Brick, 109 Leonard street, N. Y. 205
Columbian Iron Works—Wm. Taylor & Sons, 11, 13 and 15 Adams street, Brooklyn, N. Y. 204
Dealers in Iron, Copper, Brass, etc.—T. Cassidy & Co., corner of Bridge and John streets, Brooklyn, N. Y. 202
Erie Basin Iron Works—Elizabeth, Dwight and Van Dyke sts., South Brooklyn, N. Y. 199, 204
Gaylord's Great Western Pipe Foundry—Office 90 and 92 Broadway, Cincinnati, Ohio 206
Louisville Pipe Works—Dennis Long, Cor. 9th and Water-sts., Louisville, Ky. 207
Manufacturing Enamelers—Nessle & Taylor, 97 Water street, Brooklyn, N. Y. 202
National Foundry and Pipe Works—Wm. Smith, Carroll, Pike, Smallman and Wilkins streets, Pittsburgh, Pa 198
Oregon Iron Foundry—Herring & Floyd, 738, 740, 742 and 744 Greenwich street, New York 204
Pascal Iron Works—Morris, Tasker & Co., Philadelphia, Pa..207
Southwark Foundry—Merrick & Sons, Fifth and Washington streets, Philadelphia 207
Wrought Iron Pipes, etc.—Joseph Nason & Co, 61 Beekman street, New York 202

WATER METERS, PUMPS, ETC.

Aubin Water Meter—H. Q. Hawley, Albany, N. Y. 186, 207
Babcock & Wilcox's Stationary Steam Engines 198, 201
Davis' Steam Superheating Boiler—Duplex Steam Boiler Mf'g Company, Long Island City, N. Y. 198
Gaylord's Patent Couplings—Gaylord Patent Coupling Co., 31 and 33 Dey street, N. Y. 198
Putnam's Clothes Wringer—Putnam Mf'g Co., 13 Platt street, New York 205
Pat. Lead-Encased Tin Pipes—Colwells, Shaw & Willard, foot of West 27th street, N. Y. 198
Steam Pumps—H. R. Worthington, 61 Beekman st. New York.204
Steam Engines and Boilers—J. B. Fuller, 47 Dey st., N. Y. 182, 204
Water Pipes, etc.—S. Fulton & Co. 207 North Water st Phila...207
Water Closets, etc.—Wm. S. Carr & Co. 149, 151, 153, 155, 157 Centre street, New York 202
Water and Sewerage Pipes—Am. Water and Gas Pipe Company northwest corner of Green and Bay sts., Jersey City, N. J...203
Worthington's Water Meters—H. R. Worthington, 61 Beekman street, New York 199
Woodward Steam Pump Mf'g Co. 76, 78 Centre st. New York .207

CLAY RETORT WORKS.

Bay State Clay Retort Works, 125, 127 Water st, Boston, Mass.204
Brooklyn Clay Retort Works, Van Dyke st. Brooklyn, N. Y....203
Clay Retorts, Tiles, etc.—J. H. Gautier & Co. Jersey City, N. J.203
Laclede Fire Brick Works, 1007 North Levee, St. Louis, Mo....202
Manhattan Clay Retort Works, 15th st. near Av. C, New York..203
New York " " 56 Goerck street, New York...203
Philadelphia Fire Brick Works, Vine and 23d sts. Philadelphia.203

MINING MACHINERY, ETC.

Broker in Mining Stocks—C. H. Smith 5½ Pine st. New York..202
Industrial Chemistry—Prof. H. Dussauce, New Lebanon, N. Y.199
Mining Engineer—J. H. Tiemann, 240 Pearl st. New York.....202
Mining Machinery—A. Hitchcock, 4, 6, Pine st., New York....202
Notice to Mining Companies—Eng. and Supt. Richmond, Va..204
Sodium Amalgam &c.—Prof. Wurtz, 26 Pine st., New York.....202
Washington Mill and Sil. Mining Co. 36 " " " 204
School of Mines, Columbia College, East 49th st. " 199

LAMPS, STOVES, PETROLEUM, ETC.

Eddy's Kerosene Cooking Stoves—Alex. M. Lesley, 605 6th av..205
Lamps—F. H. Lovell & Co 233 Pearl street, New York.....205
Paraffine Oil—G. H. Bronson, 132 Maiden Lane New York.....202
Chimney Top—C. H. Reichmann, 45 Fulton st " 205

MISCELLANEOUS.

Bird Cages—Osborn Manufacturing Company, 109 Bleecker st..201
Books—D. Van Nostrand, 192 Broadway 202, 205
Cameron Coal Company—42 Broadway 201
Empire S. S. Line for Savannah, Garrison & Allen, 5 Bowling Green 207
Empire Shuttle Machine—T. J. McArthur, 536 Broadway..... 201
Fire Extinguisher—U. S. Fire Extinguisher Co., 8 Dey street.. 207
Finkle & Lyon Sewing Machine Company, 581 Broadway.....204
Hair Rejuvenator—J. S. Pearson & Co., 286 Jay st., Brooklyn.207
Opposition S. S. Line to California—177 West st., cor. Warren..205
Prince's Metallic Paint—D. Sloan & Co. 115 Liberty street....207
Plastic Slate Roofing Co. 157 Broadway 203
Pianos—Grovestein & Co. 499 Broadway 206
Roofing Materials—E. Van Orden & Co. 41 Liberty st..... 206
Rubber Goods—O. B. Gray, 201 Broadway 202
Steam Cooking Apparatus—Bennett, Johnson & Co., 42 Dey st., New York 201
Ventilation—Henry A. Gouge, 234 Broadway 207
Watches—T. B. Bynner 189 Broadway 183
Weed Sewing Machine Company, 506 Broadway 205

THE MINING & PETROLEUM STANDARD AND AMERICAN GAS-LIGHT JOURNAL,

is published at No. 22 Pine Street, opposite the Sub-Treasury Building on the 2d and 16th of every month, and is a recognized official organ of—

LIGHT, HEAT, MINING INTERESTS, PETROLEUM, WATER-SUPPLY, AND SCIENTIFIC SUBJECTS GENERALLY.

TERMS.

SUBSCRIPTION—Three dollars per annum in advance.

ADVERTISEMENTS.—One dollar per inch in column for each insertion inside. Outside and editorial page $2.00 per inch Large space or long time by special contract. Payable in advance.

☞ No Advertisement less than $2 00.

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NEW YORK—AMERICAN NEWS COMPANY, 119 and 121 Nassau street.
BOSTON—S. M. PETTENGILL & Co., No. 6 State Street.
PHILADELPHIA—JOY, COE & Co., No. 441 Chestnut st. cor. 5th.
Germany ... ...B. WESTERMAN & Co., of New York.
Great Britain....TRUBNER & Co., 60 Paternoster Row, London.
France. ..... } LE JOURNAL DE L'ECLAIRAGE AU GAZ, 25 Boulevard Poissonnière
Brussels, Belgium—HENRI BERGE.

☞ All communications to be addressed to "The Editors," No. 22 Pine Street, New Yo

FEB. 1868.